TECHNICAL FIELD

[Field of the Invention] This invention relates to the video camera (a still / movie video camera, and a still video camera are included) which performs automatic focus control using the video signal acquired by carrying out preliminary photography of the light figure which carries out incidence using a solid-state electronic image sensor, and its focus approach.

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Background of the Invention] There are some which have various automatic-focusing accommodation functions (the so-called AF function) in a video camera, preliminary photography of the light figure which carries out incidence with solid-state electronic image sensors, such as CCD, is carried out, and there is some they which performs focus control using the video signal acquired by this.
[0003] However, the level of the video signal outputted from a solid-state electronic image sensor will become low at the time of the photographic subject of low brightness. For this reason, the dependability of focus control becomes low and proper focus control may not be performed.
[0004]
[Description of the Invention] Even if this invention is the photographic subject of low brightness, it aims at enabling it to perform proper focus control using the video signal outputted from a solid-state electronic image sensor.
[0005] In the video camera equipped with the image pick-up optical system containing the solid-state electronic image sensor which this invention changes into a video signal the light figure which carries out incidence through an image pick-up lens and this image pick-up lens, and is outputted From the video signal outputted from the above-mentioned solid-state electronic image sensor, extract the high frequency component for focus detection, and with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component, a photometry means to measure photographic subject brightness, and the above-mentioned photometry means The level of the measured photographic subject brightness with the source of a fill-in flash and the above-mentioned judgment means for projecting a fill-in flash on the judgment means and photographic subject which judge whether it is below the predetermined level that is extent in which the focus control by the above-mentioned focus control means is impossible When judged below with the above-mentioned predetermined level, a fill-in flash is projected on a photographic subject using the above-mentioned source of a fill-in flash, and it is characterized by having the control means controlled to perform the above-mentioned focus control using the above-mentioned focus control means.
[0006] Moreover, this invention changes into a video signal the light figure which carries out incidence through an image pick-up lens and this image pick-up lens. The solid-state electronic image sensor to output In the video camera which extracted the high frequency component for focus detection, and was equipped with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component from the video signal outputted from the image pick-up optical system and the above-mentioned solid-state electronic image sensor which are included When photographic subject brightness was measured, and the level of the measured photographic subject brightness judges whether it is below the predetermined level that is extent in which the focus control processing by the above-mentioned focus control means is impossible and is judged to be below the above-mentioned predetermined level being alike -- a fill-in flash is projected on a photographic subject, and it is characterized by performing the above-mentioned focus control processing based on the above-mentioned high frequency component by the above-mentioned focus control means from which the above-mentioned high frequency component was extracted [from which

were extracted and it was extract-processed].
[0007] According to this invention, when the focus control by the above-mentioned focus control means is impossible, it is projected on a fill-in flash by the photographic subject. For this reason, the level of the video signal outputted from a solid-state electronic image sensor becomes high, and the focus control processing of it using a video signal is attained. Even if photographic subject brightness is low, it comes to be able to perform suitable focus control based on a video signal.
[0008] It is desirable to control so that a fill-in flash is projected from stroboscope luminescence equipment in the above and this luminescence quantity of light becomes fixed.
[0009] Moreover, you may make it project a fill-in flash from a red light emitting device. When a color filter is prepared in a solid-state electronic image sensor, as for this red light emitting device, it is desirable to use the red light emitting device of the same wavelength as the spectrum of the red of a color filter.
[0010] Moreover, from the video signal outputted from a solid-state electronic image sensor, the component (for example, component it can be considered that are luminance signals, such as a green signal besides a luminance signal) about a luminance signal may be extracted, measurement of photographic subject brightness may perform it based on the component about the extracted luminance signal, and a photometry component may perform it.

[Translation done.]

EXAMPLE

[Example] Hereafter, a detail is explained about the example which applied this invention to the digital still camera, referring to a drawing.
[0012] Drawing 1 is the block diagram showing the electric configuration of the digital still camera of the example of this invention.
[0013] CCD4 as diaphragm 2, the image pick-up lens 3, and a solid-state electronic image sensor (image sensors) is contained in image pick-up optical system. Although a mechanical shutter will be formed if required, generally shutter ability is attained by the electronic shutter realized by control of CCD4. Image formation of the photographic subject image is carried out to CCD4, it is moved by the image pick-up lens driving gear 25 controlled by CPU5, and the image pick-up lens 3 is positioned in a focus location.
[0014] In this example, the photometry sensor 26 is formed for a preliminary photometry, the ranging sensor 27 is formed, respectively for reserve ranging, and the photometry data and ranging data based on these sensors 26 and 27 are given to CPU5. It is made for CPU5 to enter within limits with the almost appropriate light exposure to CCD4 by controlling either [at least] a diaphragm value or shutter speed based on the photometry data obtained from the photometry sensor 26. CPU5 positions the image pick-up lens 3 near a focus location through the image pick-up lens driving gear 25 again based on the ranging data from the ranging sensor 27.
[0015] Preliminary photography is performed after the rough light exposure adjustment based on such a preliminary photometry, and the rough focus control based on reserve ranging. Calculation of a photometry value, precise exposure control, and high focus control of precision will be performed by this preliminary photography using the video signal acquired from CCD4. These highly precise exposure control and focus control are explained in full detail behind.
[0016] As for the digital still camera, the strobe lighting system is contained so that indoor photography and the other light exposure suitable by the way whose fill-in flashes are need like the after-mentioned may be obtained. This strobe lighting system is driven according to a power source 41.
[0017] The strobe lighting system is equipped with the charge circuit 40 for charging the charge given to the discharge tube (stroboscope) 45 and the discharge tube 45, the luminescence quantity of light control circuit 30 for controlling the stroboscope luminescence quantity of light, and the halt circuit 46 for stopping luminescence of the discharge tube 45.
[0018] The pressure up of the electrical potential difference of a power source 41 is carried out by the booster circuit 42, and it is charged by the main capacitor 43. The charge electrical potential difference of the main capacitor 43 is detected by giving the A/D port of CPU5 through a suitable pressure reducing circuit or an electrical-potential-difference detecting circuit. Thereby, CPU5 can know the completion of charge to the main capacitor 43.
[0019] Since CPU5 can detect the charge electrical potential difference of the main capacitor 43, it can detect the charge electrical potential difference of the main capacitor 43 before luminescence of the discharge tube 45, and the charge electrical potential difference of the main capacitor 43 after luminescence of the discharge tube 45, respectively, and can also compute the luminescence quantity of

light of the discharge tube 45 from these electrical-potential-difference differences.
[0020] Stroboscope luminescence is performed by giving stroboscope luminescence command X on to a trigger circuit 44. By giving the stroboscope luminescence command X on from CPU5 to a trigger circuit 44, a trigger circuit 44 drives, the charge stored in the main capacitor 43 discharges through the discharge tube 45, and stroboscope luminescence starts.
[0021] In the luminescence quantity of light control circuit 30, the electronic volume circuit (EVR) 31 containing D/A-converter 31A which changes and outputs the data showing the luminescence quantity of light outputted from CPU5 to a corresponding electrical potential difference is included. Moreover, the differential amplifying circuit 36 for giving a stop signal to the halt circuit 46 is included.
[0022] Furthermore, the reference supply 32 and the capacitor 34 are contained in the luminescence quantity of light control circuit 30. The output voltage of EVR31 is given to a capacitor 34 through resistance 33. The switch 35 for discharging the charge of a capacitor 34 is also formed. The reference voltage outputted from the criteria power circuit 32 is given to the negative input terminal of a differential amplifying circuit 36, and the terminal voltage of a capacitor 34 is given to the plus input terminal of a differential amplifying circuit 36.
[0023] The switch 35 is usually set to ON and becomes off by giving the stroboscope luminescence command X on of CPU5. When a switch 35 becomes off, the charge to a capacitor 34 is started based on the electrical potential difference outputted from EVR31.
[0024] An electrical potential difference is outputted from EVR31, and if a switch 35 serves as ON, a predetermined charge will be accumulated in a capacitor 34. If the terminal voltage of a capacitor 34 becomes equal to the reference voltage outputted from a reference supply 32, a stop signal will be outputted from a differential amplifying circuit 36, the halt circuit 46 will be given, and luminescence of the discharge tube 45 will stop.
[0025] In CCD4, interlace photography is performed, and the video signal (the color order of GRGB degree signal) of A field and B field is generated by turns by a substrate omission pulse, A field perpendicular transfer pulse, B field perpendicular transfer pulse, and the level transfer pulse for every 1 field period, and is read one by one. The drive (an image pick-up and read-out of a video signal) of CCD4 is performed at least the time of photography, and for the precise photometry processing and ranging processing before it.
[0026] The video signal of A field showing the photographic subject image outputted from CCD4 and B field is given to the color separation circuit 8 through the correlation duplex sampling circuit (CDS) 7, and is divided into the chrominance signal of the three primary colors, and G (green), R (red) and B (blue).
[0027] These chrominance signals G, R, and B are given to the adjustable gain amplifying circuit (henceforth GCA) 9. Although one block is shown in drawing 1 as GCA9, GCA is formed about each signal of R, G, and B in fact. In this GCA9, after amendment (henceforth color filter dispersion amendment) and white balance adjustment of dispersion between the colors of the filter of the light transmittance in the color filter prepared in CCD4 are performed, the gamma correction circuit 10 is given. This is for performing focus control mentioned later with high precision. Although what is necessary is just to perform color filter dispersion amendment at least for the purpose of focus control, if white balance adjustment is also performed in addition to this, it is much more desirable.
[0028] Gradation amendment is performed in the gamma correction circuit 10, and the output chrominance signals R, G, and B of GCA9 are inputted into a clamp and the re-sampling circuit 11.
[0029] A clamp and the re-sampling circuit 11 are GRGB which clamped three chrominance signals R, G, and B, and was in agreement with the color filter arrangement in CCD4 with re-sampling. -- It reconverts to a color sequential signal. This color sequential signal is inputted into gain control and a blanking circuit 12. Gain control and a blanking circuit 12 add a blanking signal to this while amplifying a color sequential signal on level suitable for record. The output signal of gain control and a blanking circuit 12 is given to the 1st input terminal S1 of a change-over switch 13.
[0030] As mentioned above in advance of this photography, precise photometry processing (exposure control) and focus control are performed. Photometry processing is performed using the low-frequency

component of the video signal acquired from CCD4 by preliminary photography, and focus control is performed using the high frequency component of the above-mentioned video signal.
[0031] It is YL in order to take out the low-frequency component of the video signal showing the image in the photometry field (it mentions later) prepared in the photography field of CCD4 for photometry processing. The synthetic circuit 15, the gate circuit 16, the integrating circuit 17, and the amplifying circuit 18 are formed. The output signal of an amplifying circuit 18 is given to the 2nd input terminal S2 of a change-over switch 13.
[0032] In order to take out the high frequency component of the video signal with which the image in the ranging field (it mentions later) prepared in the photography field of CCD4 for focus control is expressed on the other hand, a gate circuit 19, the band pass filter (henceforth BPF) 20, the detector circuit 21, the integrating circuit 22, and the amplifying circuit 23 are formed. The output signal of an amplifying circuit 23 is given to the 3rd input terminal S3 of a change-over switch 13.
[0033] A change-over switch 13 is controlled by CPU5, and chooses and outputs any one of the output signals of gain control and a blanking circuit 12, an amplifying circuit 18, and an amplifying circuit 23. The output signal of a change-over switch 13 is given to A/D converter 14, and is changed into digital data.
[0034] In the photometry processing and focus control before this photography, a change-over switch 13 chooses and outputs one input signal of the input terminals S2 or S3.
[0035] This photography is performed after photometry processing, the exposure control (control of a diaphragm or a shutter) based on it, and focus control (positioning of the image pick-up lens 3). At this time, a change-over switch 13 is switched so that an input terminal S1 may be chosen. It inputs into A/D converter 14 through the circuits 7, 8, 9, 10, 11, and 12 and change-over switch 13 which the video signal acquired from CCD4 by this photography mentioned above, and is changed into digital image data with this A/D converter 14, and after processing of Y/C separation, a data compression, etc. is added in a image-data-processing circuit (illustration abbreviation), it will be recorded on record media, such as memory card.
[0036] Photometry processing is first explained among the photometry processings (and exposure control based on it) and focus control before this photography.
[0037] Photometry processing is YL as mentioned above. It is carried out using the synthetic circuit 15, a gate circuit 16, an integrating circuit 17, and an amplifying circuit 18. YL The output chrominance signals R, G, and B of GCA9 are given to the synthetic circuit 15.
[0038] CPU3 outputs the reset signal HLRST1 which resets the window signal WIND1 and integrating circuit 17 which control a gate circuit 16. About the timing of these signals WIND and HLRST, it mentions later.
[0039] The chrominance signals R, G, and B outputted from GCA9 are YL. It is added in the synthetic circuit 15 and the luminance signal YL (only henceforth a luminance signal YL) of low frequency is generated relatively. This luminance signal YL It passes through the period gate circuit 16 where the window signal WIND1 is given in the necessary horizontal scanning period. An integrating circuit 17 is the luminance signal YL which it is reset when a reset signal HLRST1 is given, and is inputted from a gate circuit 16 after that. It finds the integral. After being amplified in an amplifying circuit 18, the integral signal of an integrating circuit 17 is inputted into A/D converter 14 through a change-over switch 13, just before an integrating circuit 17 is reset, is changed into the digital integral data for a photometry by this A/D converter 14, and is incorporated by CPU5 with it.
[0040] In photometry processing of this example, the average photometry (henceforth AV photometry) which measures the average brightness within a visual field, and the spot photometry (henceforth SP photometry) which measures the brightness of the main photographic subjects within a visual field are possible. SP photometry is useful when there is the need of the main photographic subjects within a visual field differing from the brightness of a background, and setting up the suitable exposure conditions according to it.
[0041] Moreover, in this example, integral by the integrating circuit 17, A/D-conversion actuation by A/D converter 14, and addition processing are performed by turns for every horizontal scanning period.

[0042] Drawing 2 shows AV photometry field and SP photometry field which were set up in the photography field 50 of CCD4.
[0043] AV photometry field -- fundamental -- the photography field 50 -- it is mostly set up over the whole region. At this example, for AV photometry field, a longitudinal direction is set as the period for 40 microseconds after the progress for 16 microseconds from falling (at the time of being initiation of a horizontal scanning period) of Horizontal Synchronizing signal HD, and a lengthwise direction is the 246th from 35th horizontal scanning Rhine. It is set to before horizontal scanning Rhine of eye watch.
[0044] SP photometry field is set as the arbitration location in the photography field 50 as a small field. It is set as the center section of the photography field 50, and, for a longitudinal direction, a lengthwise direction is [SP photometry field] the 194th from 87th horizontal scanning Rhine from falling of Horizontal Synchronizing signal HD to the period for 15 microseconds after the progress for 28.5 microseconds at this example. It is set to before horizontal scanning Rhine of eye watch.
[0045] The area for a photometry and the area for ranging are established in the memory which accompanies CPU5. There are AV photometry field data area and an SP photometry field data area in the area for a photometry.
[0046] When AV photometry is performed, the integral of every 1 horizontal-scanning Rhine in AV photometry field is performed. The above-mentioned integral is performed every 1 horizontal-scanning Rhine for A/D conversion, the reset integral of an integrating circuit, and addition processing of data.
[0047] As shown in drawing 3 , it sets to AV photometry, and it is the 246th from 34th horizontal scanning Rhine. The window signal WIND1 of 40 microseconds of pulse width is given to a gate circuit 16 after [of falling of Horizontal Synchronizing signal HD] 16 microseconds before horizontal scanning Rhine of eye watch. And luminance signal YL by the integrating circuit 17 Addition of reset of the A/D conversion of an integral and the integral signal in the next horizontal scanning period of the horizontal scanning period when this integral control action was performed, and an integrating circuit 17, and the integral data to AV photometry field data area of memory is repeatedly performed by turns for every horizontal scanning period.
[0048] When SP photometry is performed, it is the 194th from 87th horizontal scanning Rhine. The window signal WIND1 of 15 microseconds of pulse width which starts to a gate circuit 16 after [of falling of Horizontal Synchronizing signal HD] 28.5 microseconds before horizontal scanning Rhine of eye watch is given.
[0049] Also in SP photometry, the window signal WIND1 of 15 microseconds of pulse width is given to an integrating circuit 17, and it is a luminance signal YL. When an integral is performed, in the next horizontal scanning period of the horizontal scanning period when integral control action was performed, addition of the A/D conversion of an integral signal, reset of an integrating circuit 17, and the integral data to SP photometry field data area of memory is performed.
[0050] When AV photometry is performed, CPU5 is added in AV photometry field data area over 1 field period with the procedure which mentions later the integral data about 1 horizontal-scanning Rhine obtained based on the window signal WIND1 of 40 microseconds of pulse width, and calculates AV photometry value.
[0051] When SP photometry is performed, CPU5 is added in SP photometry field data area over 1 field period with the procedure which mentions later the integral data about 1 horizontal-scanning Rhine obtained based on the window signal WIND1 of 15 microseconds of pulse width, and calculates SP photometry value.
[0052] Next, focus control is explained.
[0053] With reference to drawing 1 , the output-signal of gain control and a blanking circuit 12 is again inputted into a gate circuit 19. A gate circuit 19 is controlled by the window signal WIND2 given from CPU5. The output signal of gain control and a blanking circuit 12 passes through the period and gate circuit 19 where the window signal WIND2 is given in the necessary horizontal scanning period, and inputs them into BPF20.
[0054] BPF20 takes out a high frequency component required for focus control from the input signal, and inputs the output signal of BPF20 into a detector circuit 21. After the high frequency component

signal outputted from this BPF20 is detected by the detector circuit 21, and it integrates with it in an integrating circuit 22 and it is further amplified by the amplifying circuit 23, when the change-over switch 13 has chosen the input terminal S3, it is inputted into A/D converter 14, it is changed into the digital data for focus control with that A/D converter 14, and is incorporated by CPU5.

[0055] The digital data given from A/D converter 14 is integral data obtained according to the integral over the horizontal scanning period of the focus detection field which was set up in the photography field, and which is mentioned later, and CPU5 adds this integral data over the vertical-scanning period of a focus detection field, calculates the data for focus detection, and carries out focus control based on this data. For details, it mentions later.

[0056] When the focus generally is not correct and the image is fading, there are few high frequency components contained in the video signal acquired from CCD by photography. If a focus suits, the high frequency component of a video signal will increase, and the high frequency component contained in a video signal in the location which focused correctly serves as max. In this example, focus control is performed based on such a fact, and in order to take out the high frequency component of a video signal to BPF20, the passband of about 1.5 - 2.5 MHz is set up.

[0057] Drawing 4 shows the focus detection field set up in the photography field 50 of CCD4. This focus detection field is set as the center section of the high photography field 50 of the probability for main photographic subjects to exist. Horizontally in this example, it is set up as a field smaller than SP photometry field shown in drawing 2 . Of course, it cannot be overemphasized that can set a focus detection field as the location of the arbitration in the photography field 50 at the size of arbitration.

[0058] While the window signal WIND2 of pulse width is given to a gate circuit 19 for 10 microseconds, and this window signal WIND2 is given as mentioned above after 31 microseconds pass since falling of 87th Horizontal Synchronizing signal HD as shown in drawing 5 , as for a gate circuit 19, the output signal of a circuit 12 is passed. Through a detector circuit 21, the high frequency component signal taken out by BPF20 is given to an integrating circuit 22, and it integrates with it. Through an amplifying circuit 23 and a change-over switch 13, the integral output signal of an integrating circuit 22 is changed into digital data by A/D converter 14 in the next horizontal scanning period, and is given to CPU5. An integrating circuit 22 is reset by the reset signal HLRST2 after A/D-conversion processing. This digital data is added to the data (since it is cleared at the 1st case, it is zero) of the point of the area for ranging of memory, and CPU5 memorizes it. The area for ranging is cleared in initiation of the field synchronizing with 86th Horizontal Synchronizing signal HD.

[0059] Detection of the high frequency component signal by BPF20, detection of this high frequency component signal and integral, and addition of the integral data in the A/D conversion and the horizontal scanning period of an integral signal are so performed to one horizontal scanning-as mentioned above Rhine in a focus detection field repeatedly by turns for every horizontal scanning period. And this repetition is the 194th. It is carried out over the whole region until the horizontal scanning period of eye watch (i.e., the inside of a focus detection field).

[0060] Therefore, when the scan in a focus detection field is completed, the addition data for focus detection showing the integral value covering the focus detection field whole region of the high frequency signal which passed BPF20 will be stored in the area for focus detection of memory.

[0061] As mentioned above, a near distance of even a photographic subject is measured in reserve ranging using the ranging sensor 27. based on this reserve ranging data, the image pick-up lens 4 is considered to be a focus location -- a few is sent out to a front location (it is called an initial valve position).

[0062] 10 micrometers of integral control action covering the focus detection field of the high frequency component of the video signal outputted from CCD4 are ahead performed at a time with delivery in the image pick-up lens 3 at least 6 times (namely, a six-frame period -- crossing -- B field period of each frame period -- setting). In the above-mentioned initial valve position (the amount of delivery of the image pick-up lens 3 = 0 micrometer), the 1st addition data for focus detection is obtained first. In the next frame period, the 2nd addition data for focus detection is obtained from an initial valve position in the location (the amount of image pick-up lens delivery = 10 micrometers) to which 10 micrometers of

image pick-up lenses 3 were sent out. the same -- carrying out -- the image pick-up lens 24 -- every 10 micrometers -- delivery ****** -- the 3- the 6th addition data for focus detection is obtained. Thus, the addition data of six obtained locations are memorized in the predetermined area of memory, as shown in drawing 6 .

[0063] Drawing 7 expresses with a graph the addition data for focus detection in six locations shown in drawing 6 . a small portion of focus locations of truth [initial valve position / of the image pick-up lens 3] -- it is this side. 10 micrometers of image pick-up lenses 3 are sent out at a time from this location, and the addition data for focus detection are obtained. The integral value of the RF signal included in a video signal serves as max in a true focus location. Since the amount of unit delivery of the image pick-up lens 4 is very minute distance in 10 micrometers, an error is very small even if the addition data for focus detection consider that the location which shows maximum is a true focus location. Therefore, a highly precise focus can be attained by positioning the image pick-up lens 3 in the location where the addition data for focus detection show maximum.

[0064] Drawing 8 (A) And (B) It is a time chart showing the timing of the exposure control based on preliminary photography, focus control, and this photography. Drawing 8 (A) And (B) A photographic subject is low brightness and the shown time chart shows the case where carry out Puri luminescence with a strobe lighting system, and focus control based on preliminary photography is performed.

[0065] Drawing 9 and drawing 10 show the overall procedure of a preliminary photometry, reserve ranging processing, the exposure control based on the preliminary photography performed after that, and focus control.

[0066] Time of day t1 It sets and reserve ranging based on the ranging signal from the preliminary photometry based on the photometry signal of the photometry sensor 26 and the ranging sensor 27 is performed by the push down (S1) of the 1st step of a shutter release carbon button (illustration abbreviation) (step 70). Initial setting of exposure conditions is performed based on a preliminary photometry (step 71), and the image pick-up lens 3 is sent out to an initial valve position based on reserve ranging (step 72).

[0067] Next, a change-over switch 13 is connected to an input terminal S2 (step 73). this -- time of day t1 from -- t2 up to -- the operation of a photometry and a photometry value is performed based on the video signal outputted from CCD4 as mentioned above in the period of a between (steps 74 and 75).

[0068] Thus, a judgment whether it is suitable for the calculated photometry value to use for exposure control is made (step 76). This is judging whether the integral data obtained, for example being used as a photometry value for 1 level Rhine. It sets into a part so in horizontal scanning Rhine set as the object of a photometry, and is a luminance signal YL. When saturated, the integral data is not suitable to use it as a photometry value. The upper limit of this predetermined range is the saturated luminance signal YL in consideration of the dynamic range of CCD4, GCA9, the gain of an amplifying circuit 18, etc. It is set to extent which can eliminate the based integral data. On the other hand, a part is very dark so to horizontal scanning Rhine set as the object of a photometry, and it is a luminance signal YL. Also when it is what is depended on a noise component, it is hardly appropriate to use the integral data as a photometry value. Then, the lower limit of the above-mentioned predetermined range is set to the level on which a noise component eliminates dominant integral data. Decision of being the thing of within the limits corresponding to the exposure conditions to which the photometry value was set at step 71 is also performed preferably.

[0069] the photometry value continuously acquired when the acquired photometry value was judged to be suitable to use for exposure control -- being based -- a focus -- it is judged whether it is controllable (step 80). since [in this case,] the photometry value is computed based on the video signal outputted from CCD4 -- shutter speed -- extracting -- a value -- taking into consideration -- a focus -- it is judged whether it is controllable. moreover, the photometry information acquired from the photometry component 26 -- being based -- a focus -- you may judge whether it is controllable.

[0070] Since a photographic subject is low brightness even if suitable for exposure control, using for focus control takes time amount too much, and there is an unsuitable thing. In this case, Puri luminescence by the strobe lighting system is performed, Puri luminescence is set up that focus control

of the image pick-up lens 4 should be carried out (step 81), and a flag is set to 1 (step 82).
[0071] Based on a photometry value, exposure conditions (a diaphragm value, shutter speed) are set up continuously, and the drawing value and shutter speed of a diaphragm are set up so that it may become this exposure condition (step 83). However, since a photographic subject is considered to be low brightness in this case and stroboscope luminescence is carried out in this photography in many cases, being set up so that it may become the exposure conditions corresponding to stroboscope luminescence will also be taken into consideration.
[0072] It is time of day t2 continuously. If it becomes, a change-over switch 13 will be switched to an input terminal S3 side (step 84). Drawing 8 (B) Drawing 8 (A) Time-of-day t2 -t5 It is drawing 8 (B) as a part of period is shown. Stroboscope luminescence is performed in the period when an X on signal serves as H level like at, and the stop signal serves as L level, and a video signal is read from CCD4. As this mentioned above, integral of a video signal, A/D conversion of an integral signal, and addition of integral data by which A/D conversion was carried out are so performed on the horizontal scanning line in a ranging field over the whole focus detection field (steps 85 and 90).
[0073] When the charge accumulated in the main capacitor 43 discharges, even if it emits light with the same time amount discharge tube 45, it does not become the fixed luminescence quantity of light. For this reason, it is controlled so that luminescence time amount becomes long gradually, and it always considers as the fixed luminescence quantity of light.
[0074] Based on a photometry value, when focus control is possible, YES) and a flag are set to 0 at the (step 80 (step 86).
[0075] Based on a photometry value, exposure conditions are set up continuously, and the drawing value and shutter speed of a diaphragm are set up so that it may become this exposure condition (step 87). Furthermore, a change-over switch 13 is switched to an input terminal S3 side (step 88), and the same ranging processing as step 85 is performed (step 89). However, Puri luminescence is not performed at this time.
[0076] As mentioned above, 10 micrometers of addition data for ranging are collected at a time by every frame (B field) with delivery in the image pick-up lens 3. The counter is formed in order to carry out counting of the count of delivery of the image pick-up lens 3.
[0077] If addition data are obtained about a ranging field, while incrementing the above-mentioned counter (step 91), 10 micrometers of image pick-up lenses 3 are sent out (step 92). The obtained addition data are memorized in the memory area shown in drawing 6 .
[0078] If the value of a counter does not exceed 5, a flag is investigated (step 94), if a flag becomes one, processing of steps 85, 90-94 will be repeated, and if a flag becomes zero, processing of steps 89, 90-94 will be repeated.
[0079] If the value of a counter exceeds 5, the addition data for focus detection of six batches of the area shown in drawing 6 will be compared mutually, and the maximum will be calculated (step 87). And the image pick-up lens 24 is made to carry out a variation rate to the location corresponding to the greatest addition data for focus detection, and it is positioned there. If it says in the example shown in drawing 7 , the image pick-up lens 24 will be positioned in the location sent out 30 micrometers from the initial valve position.
[0080] if a photometry and focus control are completed as mentioned above and a setup and focus of exposure conditions are performed, a change-over switch 13 will switch to an input terminal S1 -- having -- time of day t6 from -- t7 It moves to this photography within a period. When a photographic subject is low brightness, it is drawing 8 (A). An X on signal serves as H level, a stop signal serves as L level so that it may be shown, and this photography is performed to the bottom of stroboscope luminescence.
[0081] Exposure conditions are changed when judged with a photometry value being in the unsuitable range in step 76 (step 77). When a photometry value is a small value, light exposure is lessened, and light exposure is made [many] when reverse.
[0082] When the focus control of the photographic subject cannot be carried out by low brightness in an above-mentioned example, focus control of the Puri luminescence by the strobe lighting system is

performed and carried out, but even if it is not a strobe lighting system, a source of a fill-in flash like light emitting diode may be used. As for this light emitting diode, for example, red light emitting diode is used. In this case, it is desirable to use the red light emitting diode of wavelength equal to the wavelength of the red of the color filter prepared in CCD4. Thereby, since the reflected light of red light emitting diode synchronizes with a red video signal, it can prevent the irregular color of an image.
[0083] Moreover, a photometry is performed based on the video signal outputted from CCD4, and although the existence of Puri luminescence by the strobe lighting system is judged, Puri luminescence by the strobe lighting system may be judged using the so-called external acoustic emission sensor.
[0084] In ****, steps 74-79 of drawing 9 do not still necessarily need to be processed, but light exposure may be immediately determined based on a preliminary photometry.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the video camera (a still / movie video camera, and a still video camera are included) which performs automatic focus control using the video signal acquired by carrying out preliminary photography of the light figure which carries out incidence using a solid-state electronic image sensor, and its focus approach.
[0002]
[Background of the Invention] There are some which have various automatic-focusing accommodation functions (the so-called AF function) in a video camera, preliminary photography of the light figure which carries out incidence with solid-state electronic image sensors, such as CCD, is carried out, and there is some they which performs focus control using the video signal acquired by this.
[0003] However, the level of the video signal outputted from a solid-state electronic image sensor will become low at the time of the photographic subject of low brightness. For this reason, the dependability of focus control becomes low and proper focus control may not be performed.
[0004]
[Description of the Invention] Even if this invention is the photographic subject of low brightness, it aims at enabling it to perform proper focus control using the video signal outputted from a solid-state electronic image sensor.
[0005] In the video camera equipped with the image pick-up optical system containing the solid-state electronic image sensor which this invention changes into a video signal the light figure which carries out incidence through an image pick-up lens and this image pick-up lens, and is outputted From the video signal outputted from the above-mentioned solid-state electronic image sensor, extract the high frequency component for focus detection, and with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component, a photometry means to measure photographic subject brightness, and the above-mentioned photometry means The level of the measured photographic subject brightness with the source of a fill-in flash and the above-mentioned judgment means for projecting a fill-in flash on the judgment means and photographic subject which judge whether it is below the predetermined level that is extent in which the focus control by the above-mentioned focus control means is impossible When judged below with the above-mentioned predetermined level, a fill-in flash is projected on a photographic subject using the above-mentioned source of a fill-in flash, and it is characterized by having the control means controlled to perform the above-mentioned focus control using the above-mentioned focus control means.
[0006] Moreover, this invention changes into a video signal the light figure which carries out incidence through an image pick-up lens and this image pick-up lens. The solid-state electronic image sensor to output In the video camera which extracted the high frequency component for focus detection, and was equipped with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component from the video signal outputted from the image pick-up optical system and the above-mentioned solid-state electronic image sensor which are

included When photographic subject brightness was measured, and the level of the measured photographic subject brightness judges whether it is below the predetermined level that is extent in which the focus control processing by the above-mentioned focus control means is impossible and is judged to be below the above-mentioned predetermined level being alike -- a fill-in flash is projected on a photographic subject, and it is characterized by performing the above-mentioned focus control processing based on the above-mentioned high frequency component by the above-mentioned focus control means from which the above-mentioned high frequency component was extracted [from which were extracted and it was extract-processed].
[0007] According to this invention, when the focus control by the above-mentioned focus control means is impossible, it is projected on a fill-in flash by the photographic subject. For this reason, the level of the video signal outputted from a solid-state electronic image sensor becomes high, and the focus control processing of it using a video signal is attained. Even if photographic subject brightness is low, it comes to be able to perform suitable focus control based on a video signal.
[0008] It is desirable to control so that a fill-in flash is projected from stroboscope luminescence equipment in the above and this luminescence quantity of light becomes fixed.
[0009] Moreover, you may make it project a fill-in flash from a red light emitting device. When a color filter is prepared in a solid-state electronic image sensor, as for this red light emitting device, it is desirable to use the red light emitting device of the same wavelength as the spectrum of the red of a color filter.
[0010] Moreover, from the video signal outputted from a solid-state electronic image sensor, the component (for example, component it can be considered that are luminance signals, such as a green signal besides a luminance signal) about a luminance signal may be extracted, measurement of photographic subject brightness may perform it based on the component about the extracted luminance signal, and a photometry component may perform it.
[0011]
[Example] Hereafter, a detail is explained about the example which applied this invention to the digital still camera, referring to a drawing.
[0012] Drawing 1 is the block diagram showing the electric configuration of the digital still camera of the example of this invention.
[0013] CCD4 as diaphragm 2, the image pick-up lens 3, and a solid-state electronic image sensor (image sensors) is contained in image pick-up optical system. Although a mechanical shutter will be formed if required, generally shutter ability is attained by the electronic shutter realized by control of CCD4. Image formation of the photographic subject image is carried out to CCD4, it is moved by the image pick-up lens driving gear 25 controlled by CPU5, and the image pick-up lens 3 is positioned in a focus location.
[0014] In this example, the photometry sensor 26 is formed for a preliminary photometry, the ranging sensor 27 is formed, respectively for reserve ranging, and the photometry data and ranging data based on these sensors 26 and 27 are given to CPU5. It is made for CPU5 to enter within limits with the almost appropriate light exposure to CCD4 by controlling either [at least] a diaphragm value or shutter speed based on the photometry data obtained from the photometry sensor 26. CPU5 positions the image pick-up lens 3 near a focus location through the image pick-up lens driving gear 25 again based on the ranging data from the ranging sensor 27.
[0015] Preliminary photography is performed after the rough light exposure adjustment based on such a preliminary photometry, and the rough focus control based on reserve ranging. Calculation of a photometry value, precise exposure control, and high focus control of precision will be performed by this preliminary photography using the video signal acquired from CCD4. These highly precise exposure control and focus control are explained in full detail behind.
[0016] As for the digital still camera, the strobe lighting system is contained so that indoor photography and the other light exposure suitable by the way whose fill-in flashes are need like the after-mentioned may be obtained. This strobe lighting system is driven according to a power source 41.
[0017] The strobe lighting system is equipped with the charge circuit 40 for charging the charge given to

the discharge tube (stroboscope) 45 and the discharge tube 45, the luminescence quantity of light control circuit 30 for controlling the stroboscope luminescence quantity of light, and the halt circuit 46 for stopping luminescence of the discharge tube 45.
[0018] The pressure up of the electrical potential difference of a power source 41 is carried out by the booster circuit 42, and it is charged by the main capacitor 43. The charge electrical potential difference of the main capacitor 43 is detected by giving the A/D port of CPU5 through a suitable pressure reducing circuit or an electrical-potential-difference detecting circuit. Thereby, CPU5 can know the completion of charge to the main capacitor 43.
[0019] Since CPU5 can detect the charge electrical potential difference of the main capacitor 43, it can detect the charge electrical potential difference of the main capacitor 43 before luminescence of the discharge tube 45, and the charge electrical potential difference of the main capacitor 43 after luminescence of the discharge tube 45, respectively, and can also compute the luminescence quantity of light of the discharge tube 45 from these electrical-potential-difference differences.
[0020] Stroboscope luminescence is performed by giving stroboscope luminescence command X on to a trigger circuit 44. By giving the stroboscope luminescence command X on from CPU5 to a trigger circuit 44, a trigger circuit 44 drives, the charge stored in the main capacitor 43 discharges through the discharge tube 45, and stroboscope luminescence starts.
[0021] In the luminescence quantity of light control circuit 30, the electronic volume circuit (EVR) 31 containing D/A-converter 31A which changes and outputs the data showing the luminescence quantity of light outputted from CPU5 to a corresponding electrical potential difference is included. Moreover, the differential amplifying circuit 36 for giving a stop signal to the halt circuit 46 is included.
[0022] Furthermore, the reference supply 32 and the capacitor 34 are contained in the luminescence quantity of light control circuit 30. The output voltage of EVR31 is given to a capacitor 34 through resistance 33. The switch 35 for discharging the charge of a capacitor 34 is also formed. The reference voltage outputted from the criteria power circuit 32 is given to the negative input terminal of a differential amplifying circuit 36, and the terminal voltage of a capacitor 34 is given to the plus input terminal of a differential amplifying circuit 36.
[0023] The switch 35 is usually set to ON and becomes off by giving the stroboscope luminescence command X on of CPU5. When a switch 35 becomes off, the charge to a capacitor 34 is started based on the electrical potential difference outputted from EVR31.
[0024] An electrical potential difference is outputted from EVR31, and if a switch 35 serves as ON, a predetermined charge will be accumulated in a capacitor 34. If the terminal voltage of a capacitor 34 becomes equal to the reference voltage outputted from a reference supply 32, a stop signal will be outputted from a differential amplifying circuit 36, the halt circuit 46 will be given, and luminescence of the discharge tube 45 will stop.
[0025] In CCD4, interlace photography is performed, and the video signal (the color order of GRGB degree signal) of A field and B field is generated by turns by a substrate omission pulse, A field perpendicular transfer pulse, B field perpendicular transfer pulse, and the level transfer pulse for every 1 field period, and is read one by one. The drive (an image pick-up and read-out of a video signal) of CCD4 is performed at least the time of photography, and for the precise photometry processing and ranging processing before it.
[0026] The video signal of A field showing the photographic subject image outputted from CCD4 and B field is given to the color separation circuit 8 through the correlation duplex sampling circuit (CDS) 7, and is divided into the chrominance signal of the three primary colors, and G (green), R (red) and B (blue).
[0027] These chrominance signals G, R, and B are given to the adjustable gain amplifying circuit (henceforth GCA) 9. Although one block is shown in drawing 1 as GCA9, GCA is formed about each signal of R, G, and B in fact. In this GCA9, after amendment (henceforth color filter dispersion amendment) and white balance adjustment of dispersion between the colors of the filter of the light transmittance in the color filter prepared in CCD4 are performed, the gamma correction circuit 10 is given. This is for performing focus control mentioned later with high precision. Although what is

necessary is just to perform color filter dispersion amendment at least for the purpose of focus control, if white balance adjustment is also performed in addition to this, it is much more desirable.
[0028] Gradation amendment is performed in the gamma correction circuit 10, and the output chrominance signals R, G, and B of GCA9 are inputted into a clamp and the re-sampling circuit 11.
[0029] A clamp and the re-sampling circuit 11 are GRGB which clamped three chrominance signals R, G, and B, and was in agreement with the color filter arrangement in CCD4 with re-sampling. -- It reconverts to a color sequential signal. This color sequential signal is inputted into gain control and a blanking circuit 12. Gain control and a blanking circuit 12 add a blanking signal to this while amplifying a color sequential signal on level suitable for record. The output signal of gain control and a blanking circuit 12 is given to the 1st input terminal S1 of a change-over switch 13.
[0030] As mentioned above in advance of this photography, precise photometry processing (exposure control) and focus control are performed. Photometry processing is performed using the low-frequency component of the video signal acquired from CCD4 by preliminary photography, and focus control is performed using the high frequency component of the above-mentioned video signal.
[0031] It is YL in order to take out the low-frequency component of the video signal showing the image in the photometry field (it mentions later) prepared in the photography field of CCD4 for photometry processing. The synthetic circuit 15, the gate circuit 16, the integrating circuit 17, and the amplifying circuit 18 are formed. The output signal of an amplifying circuit 18 is given to the 2nd input terminal S2 of a change-over switch 13.
[0032] In order to take out the high frequency component of the video signal with which the image in the ranging field (it mentions later) prepared in the photography field of CCD4 for focus control is expressed on the other hand, a gate circuit 19, the band pass filter (henceforth BPF) 20, the detector circuit 21, the integrating circuit 22, and the amplifying circuit 23 are formed. The output signal of an amplifying circuit 23 is given to the 3rd input terminal S3 of a change-over switch 13.
[0033] A change-over switch 13 is controlled by CPU5, and chooses and outputs any one of the output signals of gain control and a blanking circuit 12, an amplifying circuit 18, and an amplifying circuit 23. The output signal of a change-over switch 13 is given to A/D converter 14, and is changed into digital data.
[0034] In the photometry processing and focus control before this photography, a change-over switch 13 chooses and outputs one input signal of the input terminals S2 or S3.
[0035] This photography is performed after photometry processing, the exposure control (control of a diaphragm or a shutter) based on it, and focus control (positioning of the image pick-up lens 3). At this time, a change-over switch 13 is switched so that an input terminal S1 may be chosen. It inputs into A/D converter 14 through the circuits 7, 8, 9, 10, 11, and 12 and change-over switch 13 which the video signal acquired from CCD4 by this photography mentioned above, and is changed into digital image data with this A/D converter 14, and after processing of Y/C separation, a data compression, etc. is added in a image-data-processing circuit (illustration abbreviation), it will be recorded on record media, such as memory card.
[0036] Photometry processing is first explained among the photometry processings (and exposure control based on it) and focus control before this photography.
[0037] Photometry processing is YL as mentioned above. It is carried out using the synthetic circuit 15, a gate circuit 16, an integrating circuit 17, and an amplifying circuit 18. YL The output chrominance signals R, G, and B of GCA9 are given to the synthetic circuit 15.
[0038] CPU3 outputs the reset signal HLRST1 which resets the window signal WIND1 and integrating circuit 17 which control a gate circuit 16. About the timing of these signals WIND and HLRST, it mentions later.
[0039] The chrominance signals R, G, and B outputted from GCA9 are YL. It is added in the synthetic circuit 15 and the luminance signal YL (only henceforth a luminance signal YL) of low frequency is generated relatively. This luminance signal YL It passes through the period gate circuit 16 where the window signal WIND1 is given in the necessary horizontal scanning period. An integrating circuit 17 is the luminance signal YL which it is reset when a reset signal HLRST1 is given, and is inputted from a

gate circuit 16 after that. It finds the integral. After being amplified in an amplifying circuit 18, the integral signal of an integrating circuit 17 is inputted into A/D converter 14 through a change-over switch 13, just before an integrating circuit 17 is reset, is changed into the digital integral data for a photometry by this A/D converter 14, and is incorporated by CPU5 with it.

[0040] In photometry processing of this example, the average photometry (henceforth AV photometry) which measures the average brightness within a visual field, and the spot photometry (henceforth SP photometry) which measures the brightness of the main photographic subjects within a visual field are possible. SP photometry is useful when there is the need of the main photographic subjects within a visual field differing from the brightness of a background, and setting up the suitable exposure conditions according to it.

[0041] Moreover, in this example, integral by the integrating circuit 17, A/D-conversion actuation by A/D converter 14, and addition processing are performed by turns for every horizontal scanning period.

[0042] Drawing 2 shows AV photometry field and SP photometry field which were set up in the photography field 50 of CCD4.

[0043] AV photometry field -- fundamental -- the photography field 50 -- it is mostly set up over the whole region. At this example, for AV photometry field, a longitudinal direction is set as the period for 40 microseconds after the progress for 16 microseconds from falling (at the time of being initiation of a horizontal scanning period) of Horizontal Synchronizing signal HD, and a lengthwise direction is the 246th from 35th horizontal scanning Rhine. It is set to before horizontal scanning Rhine of eye watch.

[0044] SP photometry field is set as the arbitration location in the photography field 50 as a small field. It is set as the center section of the photography field 50, and, for a longitudinal direction, a lengthwise direction is [SP photometry field] the 194th from 87th horizontal scanning Rhine from falling of Horizontal Synchronizing signal HD to the period for 15 microseconds after the progress for 28.5 microseconds at this example. It is set to before horizontal scanning Rhine of eye watch.

[0045] The area for a photometry and the area for ranging are established in the memory which accompanies CPU5. There are AV photometry field data area and an SP photometry field data area in the area for a photometry.

[0046] When AV photometry is performed, the integral of every 1 horizontal-scanning Rhine in AV photometry field is performed. The above-mentioned integral is performed every 1 horizontal-scanning Rhine for A/D conversion, the reset integral of an integrating circuit, and addition processing of data.

[0047] As shown in drawing 3 , it sets to AV photometry, and it is the 246th from 34th horizontal scanning Rhine. The window signal WIND1 of 40 microseconds of pulse width is given to a gate circuit 16 after [of falling of Horizontal Synchronizing signal HD] 16 microseconds before horizontal scanning Rhine of eye watch. And luminance signal YL by the integrating circuit 17 Addition of reset of the A/D conversion of an integral and the integral signal in the next horizontal scanning period of the horizontal scanning period when this integral control action was performed, and an integrating circuit 17, and the integral data to AV photometry field data area of memory is repeatedly performed by turns for every horizontal scanning period.

[0048] When SP photometry is performed, it is the 194th from 87th horizontal scanning Rhine. The window signal WIND1 of 15 microseconds of pulse width which starts to a gate circuit 16 after [of falling of Horizontal Synchronizing signal HD] 28.5 microseconds before horizontal scanning Rhine of eye watch is given.

[0049] Also in SP photometry, the window signal WIND1 of 15 microseconds of pulse width is given to an integrating circuit 17, and it is a luminance signal YL. When an integral is performed, in the next horizontal scanning period of the horizontal scanning period when integral control action was performed, addition of the A/D conversion of an integral signal, reset of an integrating circuit 17, and the integral data to SP photometry field data area of memory is performed.

[0050] When AV photometry is performed, CPU5 is added in AV photometry field data area over 1 field period with the procedure which mentions later the integral data about 1 horizontal-scanning Rhine obtained based on the window signal WIND1 of 40 microseconds of pulse width, and calculates AV photometry value.

[0051] When SP photometry is performed, CPU5 is added in SP photometry field data area over 1 field period with the procedure which mentions later the integral data about 1 horizontal-scanning Rhine obtained based on the window signal WIND1 of 15 microseconds of pulse width, and calculates SP photometry value.
[0052] Next, focus control is explained.
[0053] With reference to drawing 1 , the output signal of gain control and a blanking circuit 12 is again inputted into a gate circuit 19. A gate circuit 19 is controlled by the window signal WIND2 given from CPU5. The output signal of gain control and a blanking circuit 12 passes through the period and gate circuit 19 where the window signal WIND2 is given in the necessary horizontal scanning period, and inputs them into BPF20.
[0054] BPF20 takes out a high frequency component required for focus control from the input signal, and inputs the output signal of BPF20 into a detector circuit 21. After the high frequency component signal outputted from this BPF20 is detected by the detector circuit 21, and it integrates with it in an integrating circuit 22 and it is further amplified by the amplifying circuit 23, when the change-over switch 13 has chosen the input terminal S3, it is inputted into A/D converter 14, it is changed into the digital data for focus control with that A/D converter 14, and is incorporated by CPU5.
[0055] The digital data given from A/D converter 14 is integral data obtained according to the integral over the horizontal scanning period of the focus detection field which was set up in the photography field, and which is mentioned later, and CPU5 adds this integral data over the vertical-scanning period of a focus detection field, calculates the data for focus detection, and carries out focus control based on this data. For details, it mentions later.
[0056] When the focus generally is not correct and the image is fading, there are few high frequency components contained in the video signal acquired from CCD by photography. If a focus suits, the high frequency component of a video signal will increase, and the high frequency component contained in a video signal in the location which focused correctly serves as max. In this example, focus control is performed based on such a fact, and in order to take out the high frequency component of a video signal to BPF20, the passband of about 1.5 - 2.5 MHz is set up.
[0057] Drawing 4 shows the focus detection field set up in the photography field 50 of CCD4. This focus detection field is set as the center section of the high photography field 50 of the probability for main photographic subjects to exist. Horizontally in this example, it is set up as a field smaller than SP photometry field shown in drawing 2 . Of course, it cannot be overemphasized that can set a focus detection field as the location of the arbitration in the photography field 50 at the size of arbitration.
[0058] While the window signal WIND2 of pulse width is given to a gate circuit 19 for 10 microseconds, and this window signal WIND2 is given as mentioned above after 31 microseconds pass since falling of 87th Horizontal Synchronizing signal HD as shown in drawing 5 , as for a gate circuit 19, the output signal of a circuit 12 is passed. Through a detector circuit 21, the high frequency component signal taken out by BPF20 is given to an integrating circuit 22, and it integrates with it. Through an amplifying circuit 23 and a change-over switch 13, the integral output signal of an integrating circuit 22 is changed into digital data by A/D converter 14 in the next horizontal scanning period, and is given to CPU5. An integrating circuit 22 is reset by the reset signal HLRST2 after A/D-conversion processing. This digital data is added to the data (since it is cleared at the 1st case, it is zero) of the point of the area for ranging of memory, and CPU5 memorizes it. The area for ranging is cleared in initiation of the field synchronizing with 86th Horizontal Synchronizing signal HD.
[0059] Detection of the high frequency component signal by BPF20, detection of this high frequency component signal and integral, and addition of the integral data in the A/D conversion and the horizontal scanning period of an integral signal are so performed to one horizontal scanning-as mentioned above Rhine in a focus detection field repeatedly by turns for every horizontal scanning period. And this repetition is the 194th. It is carried out over the whole region until the horizontal scanning period of eye watch (i.e., the inside of a focus detection field).
[0060] Therefore, when the scan in a focus detection field is completed, the addition data for focus detection showing the integral value covering the focus detection field whole region of the high

frequency signal which passed BPF20 will be stored in the area for focus detection of memory.
[0061] As mentioned above, a near distance of even a photographic subject is measured in reserve ranging using the ranging sensor 27. based on this reserve ranging data, the image pick-up lens 4 is considered to be a focus location -- a few is sent out to a front location (it is called an initial valve position).
[0062] 10 micrometers of integral control action covering the focus detection field of the high frequency component of the video signal outputted from CCD4 are ahead performed at a time with delivery in the image pick-up lens 3 at least 6 times (namely, a six-frame period -- crossing -- B field period of each frame period -- setting). In the above-mentioned initial valve position (the amount of delivery of the image pick-up lens 3 = 0 micrometer), the 1st addition data for focus detection is obtained first. In the next frame period, the 2nd addition data for focus detection is obtained from an initial valve position in the location (the amount of image pick-up lens delivery = 10 micrometers) to which 10 micrometers of image pick-up lenses 3 were sent out. the same -- carrying out -- the image pick-up lens 24 -- every 10 micrometers -- delivery ****** -- the 3- the 6th addition data for focus detection is obtained. Thus, the addition data of six obtained locations are memorized in the predetermined area of memory, as shown in drawing 6 .
[0063] Drawing 7 expresses with a graph the addition data for focus detection in six locations shown in drawing 6 . a small portion of focus locations of truth [initial valve position / of the image pick-up lens 3] -- it is this side. 10 micrometers of image pick-up lenses 3 are sent out at a time from this location, and the addition data for focus detection are obtained. The integral value of the RF signal included in a video signal serves as max in a true focus location. Since the amount of unit delivery of the image pick-up lens 4 is very minute distance in 10 micrometers, an error is very small even if the addition data for focus detection consider that the location which shows maximum is a true focus location. Therefore, a highly precise focus can be attained by positioning the image pick-up lens 3 in the location where the addition data for focus detection show maximum.
[0064] Drawing 8 (A) And (B) It is a time chart showing the timing of the exposure control based on preliminary photography, focus control, and this photography. Drawing 8 (A) And (B) A photographic subject is low brightness and the shown time chart shows the case where carry out Puri luminescence with a strobe lighting system, and focus control based on preliminary photography is performed.
[0065] Drawing 9 and drawing 10 show the overall procedure of a preliminary photometry, reserve ranging processing, the exposure control based on the preliminary photography performed after that, and focus control.
[0066] Time of day t1 It sets and reserve ranging based on the ranging signal from the preliminary photometry based on the photometry signal of the photometry sensor 26 and the ranging sensor 27 is performed by the push down (S1) of the 1st step of a shutter release carbon button (illustration abbreviation) (step 70). Initial setting of exposure conditions is performed based on a preliminary photometry (step 71), and the image pick-up lens 3 is sent out to an initial valve position based on reserve ranging (step 72).
[0067] Next, a change-over switch 13 is connected to an input terminal S2 (step 73). this -- time of day t1 from -- t2 up to -- the operation of a photometry and a photometry value is performed based on the video signal outputted from CCD4 as mentioned above in the period of a between (steps 74 and 75).
[0068] Thus, a judgment whether it is suitable for the calculated photometry value to use for exposure control is made (step 76). This is judging whether the integral data obtained, for example being used as a photometry value for 1 level Rhine. It sets into a part so in horizontal scanning Rhine set as the object of a photometry, and is a luminance signal YL. When saturated, the integral data is not suitable to use it as a photometry value. The upper limit of this predetermined range is the saturated luminance signal YL in consideration of the dynamic range of CCD4, GCA9, the gain of an amplifying circuit 18, etc. It is set to extent which can eliminate the based integral data. On the other hand, a part is very dark so to horizontal scanning Rhine set as the object of a photometry, and it is a luminance signal YL. Also when it is what is depended on a noise component, it is hardly appropriate to use the integral data as a photometry value. Then, the lower limit of the above-mentioned predetermined range is set to the level on which a noise

component eliminates dominant integral data. Decision of being the thing of within the limits corresponding to the exposure conditions to which the photometry value was set at step 71 is also performed preferably.
[0069] the photometry value continuously acquired when the acquired photometry value was judged to be suitable to use for exposure control -- being based -- a focus -- it is judged whether it is controllable (step 80). since [in this case,] the photometry value is computed based on the video signal outputted from CCD4 -- shutter speed -- extracting -- a value -- taking into consideration -- a focus -- it is judged whether it is controllable. moreover, the photometry information acquired from the photometry component 26 -- being based -- a focus -- you may judge whether it is controllable.
[0070] Since a photographic subject is low brightness even if suitable for exposure control, using for focus control takes time amount too much, and there is an unsuitable thing. In this case, Puri luminescence by the strobe lighting system is performed, Puri luminescence is set up that focus control of the image pick-up lens 4 should be carried out (step 81), and a flag is set to 1 (step 82).
[0071] Based on a photometry value, exposure conditions (a diaphragm value, shutter speed) are set up continuously, and the drawing value and shutter speed of a diaphragm are set up so that it may become this exposure condition (step 83). However, since a photographic subject is considered to be low brightness in this case and stroboscope luminescence is carried out in this photography in many cases, being set up so that it may become the exposure conditions corresponding to stroboscope luminescence will also be taken into consideration.
[0072] It is time of day t2 continuously. If it becomes, a change-over switch 13 will be switched to an input terminal S3 side (step 84). Drawing 8 (B) Drawing 8 (A) Time-of-day t2 -t5 It is drawing 8 (B) as a part of period is shown. Stroboscope luminescence is performed in the period when an X on signal serves as H level like at, and the stop signal serves as L level, and a video signal is read from CCD4. As this mentioned above, integral of a video signal, A/D conversion of an integral signal, and addition of integral data by which A/D conversion was carried out are so performed on the horizontal scanning line in a ranging field over the whole focus detection field (steps 85 and 90).
[0073] When the charge accumulated in the main capacitor 43 discharges, even if it emits light with the same time amount discharge tube 45, it does not become the fixed luminescence quantity of light. For this reason, it is controlled so that luminescence time amount becomes long gradually, and it always considers as the fixed luminescence quantity of light.
[0074] Based on a photometry value, when focus control is possible, YES) and a flag are set to 0 at the (step 80 (step 86).
[0075] Based on a photometry value, exposure conditions are set up continuously, and the drawing value and shutter speed of a diaphragm are set up so that it may become this exposure condition (step 87). Furthermore, a change-over switch 13 is switched to an input terminal S3 side (step 88), and the same ranging processing as step 85 is performed (step 89). However, Puri luminescence is not performed at this time.
[0076] As mentioned above, 10 micrometers of addition data for ranging are collected at a time by every frame (B field) with delivery in the image pick-up lens 3. The counter is formed in order to carry out counting of the count of delivery of the image pick-up lens 3.
[0077] If addition data are obtained about a ranging field, while incrementing the above-mentioned counter (step 91), 10 micrometers of image pick-up lenses 3 are sent out (step 92). The obtained addition data are memorized in the memory area shown in drawing 6 .
[0078] If the value of a counter does not exceed 5, a flag is investigated (step 94), if a flag becomes one, processing of steps 85, 90-94 will be repeated, and if a flag becomes zero, processing of steps 89, 90-94 will be repeated.
[0079] If the value of a counter exceeds 5, the addition data for focus detection of six batches of the area shown in drawing 6 will be compared mutually, and the maximum will be calculated (step 87). And the image pick-up lens 24 is made to carry out a variation rate to the location corresponding to the greatest addition data for focus detection, and it is positioned there. If it says in the example shown in drawing 7 , the image pick-up lens 24 will be positioned in the location sent out 30 micrometers from the initial

valve position.

[0080] if a photometry and focus control are completed as mentioned above and a setup and focus of exposure conditions are performed, a change-over switch 13 will switch to an input terminal S1 -- having -- time of day t6 from -- t7 It moves to this photography within a period. When a photographic subject is low brightness, it is drawing 8 (A). An X on signal serves as H level, a stop signal serves as L level so that it may be shown, and this photography is performed to the bottom of stroboscope luminescence.

[0081] Exposure conditions are changed when judged with a photometry value being in the unsuitable range in step 76 (step 77). When a photometry value is a small value, light exposure is lessened, and light exposure is made [many] when reverse.

[0082] When the focus control of the photographic subject cannot be carried out by low brightness in an above-mentioned example, focus control of the Puri luminescence by the strobe lighting system is performed and carried out, but even if it is not a strobe lighting system, a source of a fill-in flash like light emitting diode may be used. As for this light emitting diode, for example, red light emitting diode is used. In this case, it is desirable to use the red light emitting diode of wavelength equal to the wavelength of the red of the color filter prepared in CCD4. Thereby, since the reflected light of red light emitting diode synchronizes with a red video signal, it can prevent the irregular color of an image.

[0083] Moreover, a photometry is performed based on the video signal outputted from CCD4, and although the existence of Puri luminescence by the strobe lighting system is judged, Puri luminescence by the strobe lighting system may be judged using the so-called external acoustic emission sensor.

[0084] In ****, steps 74-79 of drawing 9 do not still necessarily need to be processed, but light exposure may be immediately determined based on a preliminary photometry.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the electric configuration of the digital still video camera by the example of this invention.
[Drawing 2] It is drawing showing the photometry field set up in the photography field.
[Drawing 3] It is the time chart which shows photometry processing.
[Drawing 4] It is drawing showing the ranging field set up in the photography field.
[Drawing 5] It is the time chart which shows ranging processing.
[Drawing 6] It is drawing showing the addition data storage area for focus detection.
[Drawing 7] It is the graph which shows the addition data for focus detection.
[Drawing 8] (A) And (B) It is the time chart which shows the procedure of processing of exposure control and focus control.
[Drawing 9] It is the flow chart which shows the procedure of processing of the exposure control and focus control by CPU.
[Drawing 10] It is the flow chart which shows the procedure of processing of the exposure control and focus control by CPU.
[Description of Notations]
4 CCD (Solid-state Electronic Image Sensor)
5 CPU
19 Gate Circuit
20 Band Pass Filter
21 Detector Circuit
22 Integrating Circuit
23 Amplifying Circuit
24 Image Pick-up Lens
25 Image Pick-up Lens Driving Gear
26 Photometry Sensor
27 Ranging Sensor
30 Luminescence Quantity of Light Control Circuit
40 Charge Circuit
45 Discharge Tube
46 Halt Circuit

[Translation done.]

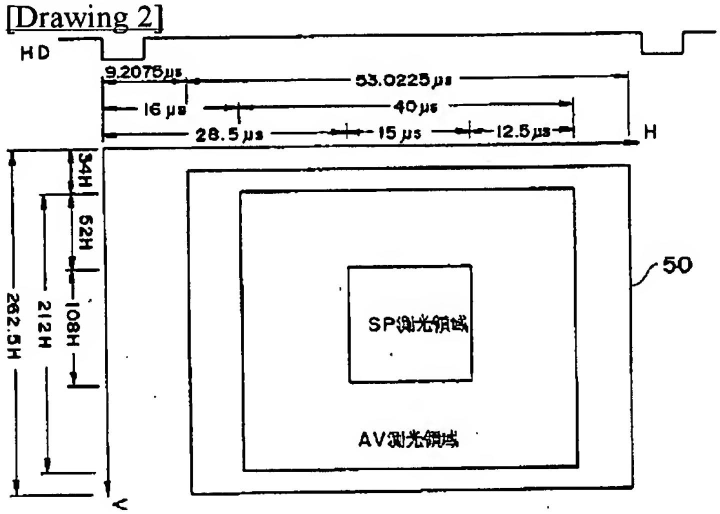
* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

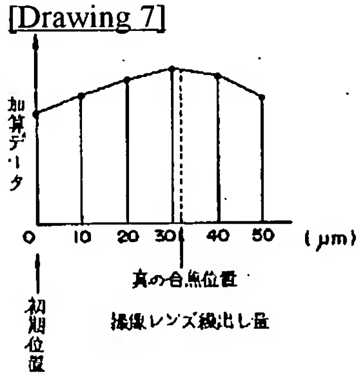
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

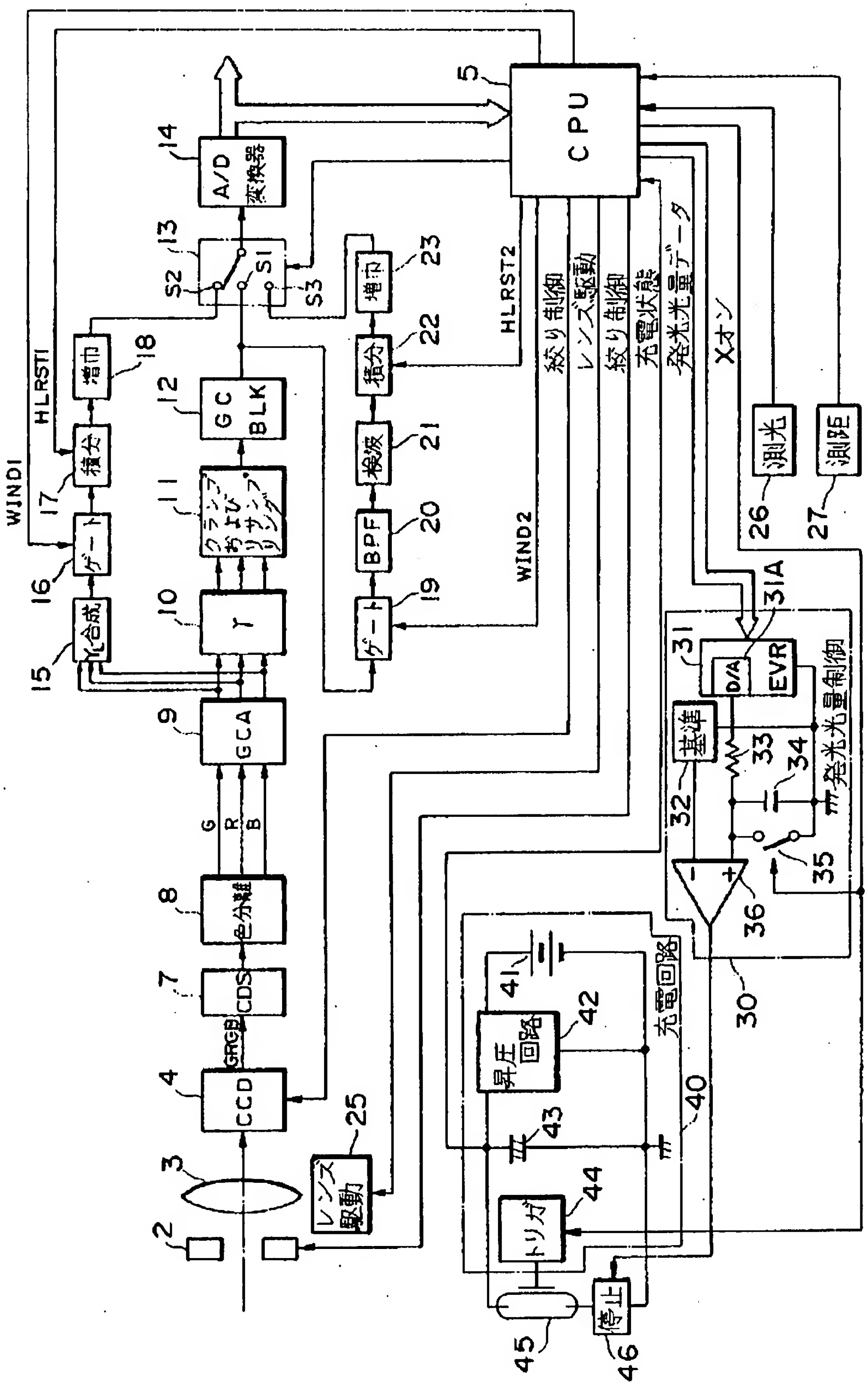
[Drawing 2]



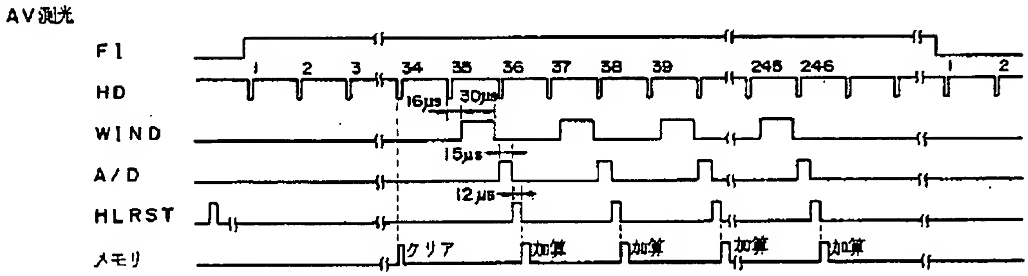
[Drawing 7]



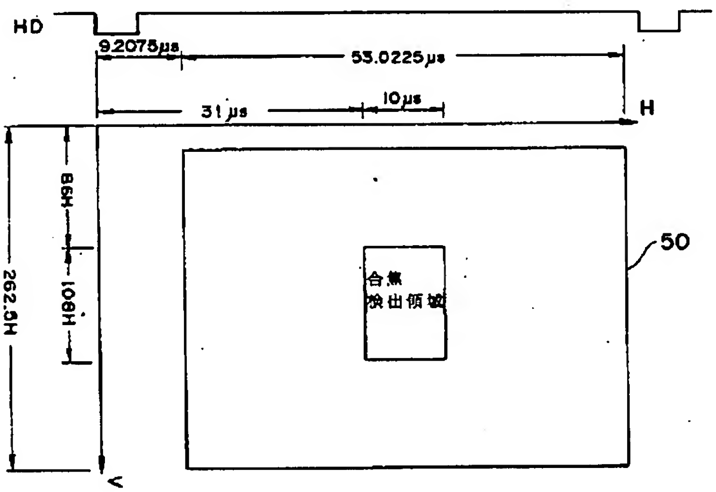
[Drawing 1]


CPU
A/D 変換器
GC BLK
クランプおよびサンプリング
γ
GCA
色分離
CDS
CCD
GRGB
G
R
B
色合成
ゲート
積分
増巾
BPF
検波
HLRST1
HLRST2
WIND1
WIND2
S1
S2
S3
絞り制御
レンズ駆動
充電状態
発光光量データ
Xオン
測光
測距
レンズ駆動
D/A
EVR
基準
発光光量制御
充電回路
昇圧回路
トリガ
停止

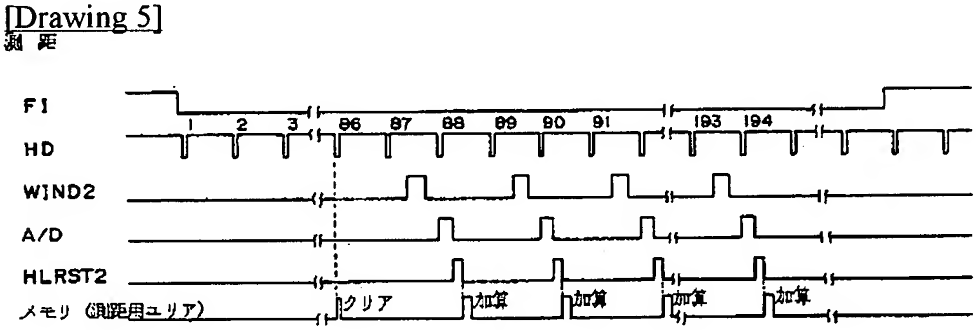
[Drawing 3]



[Drawing 4]



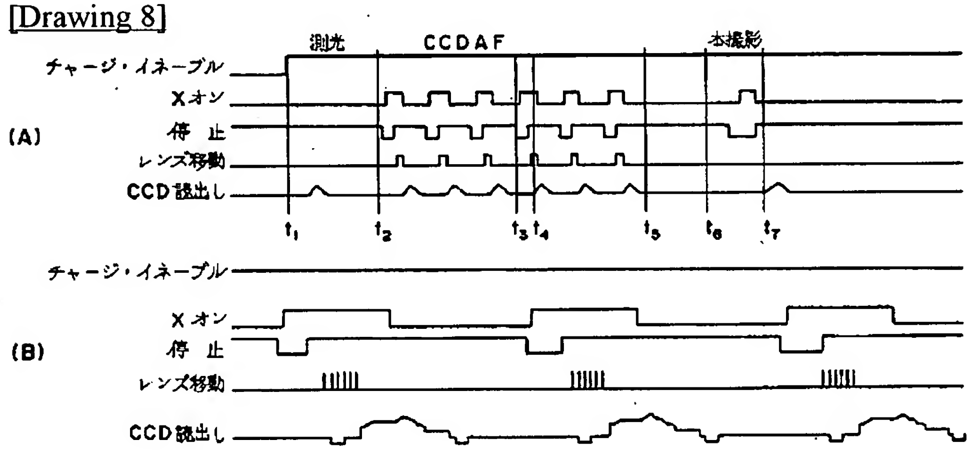
[Drawing 5]



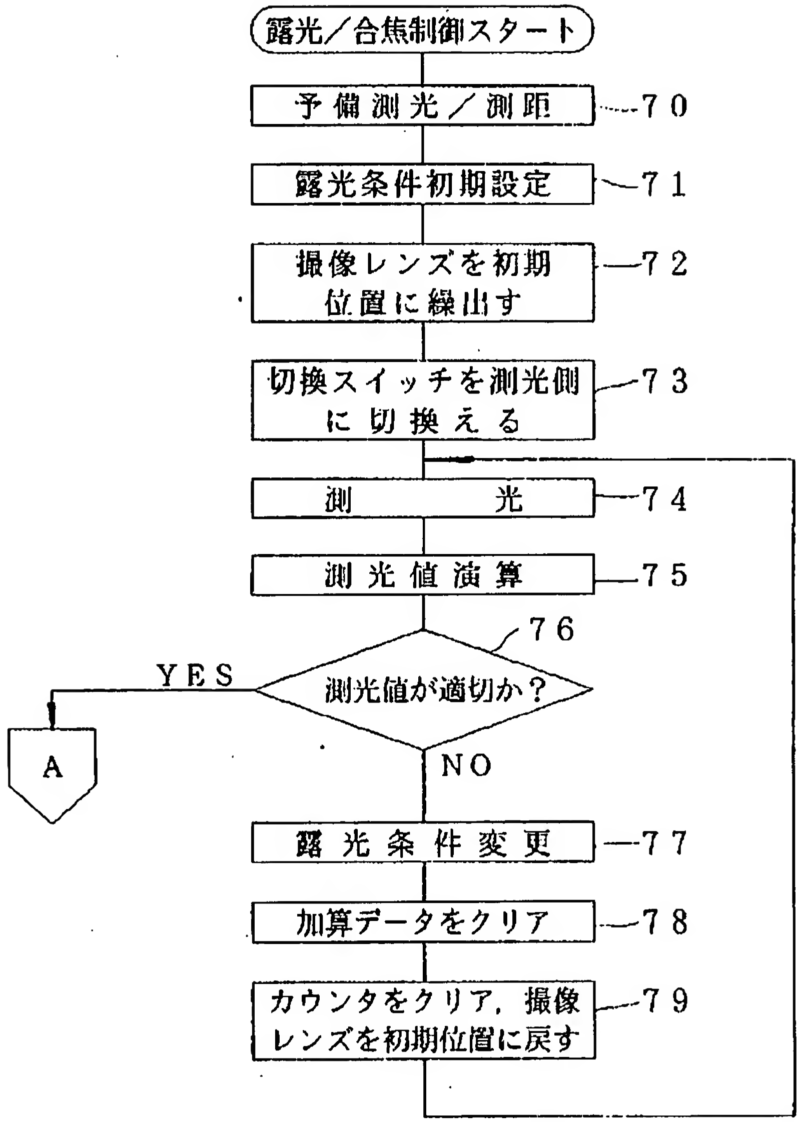
[Drawing 6]

撮像レンズの繰出し量（μm）	加算データ
0	
10	
20	
30	
40	
50	

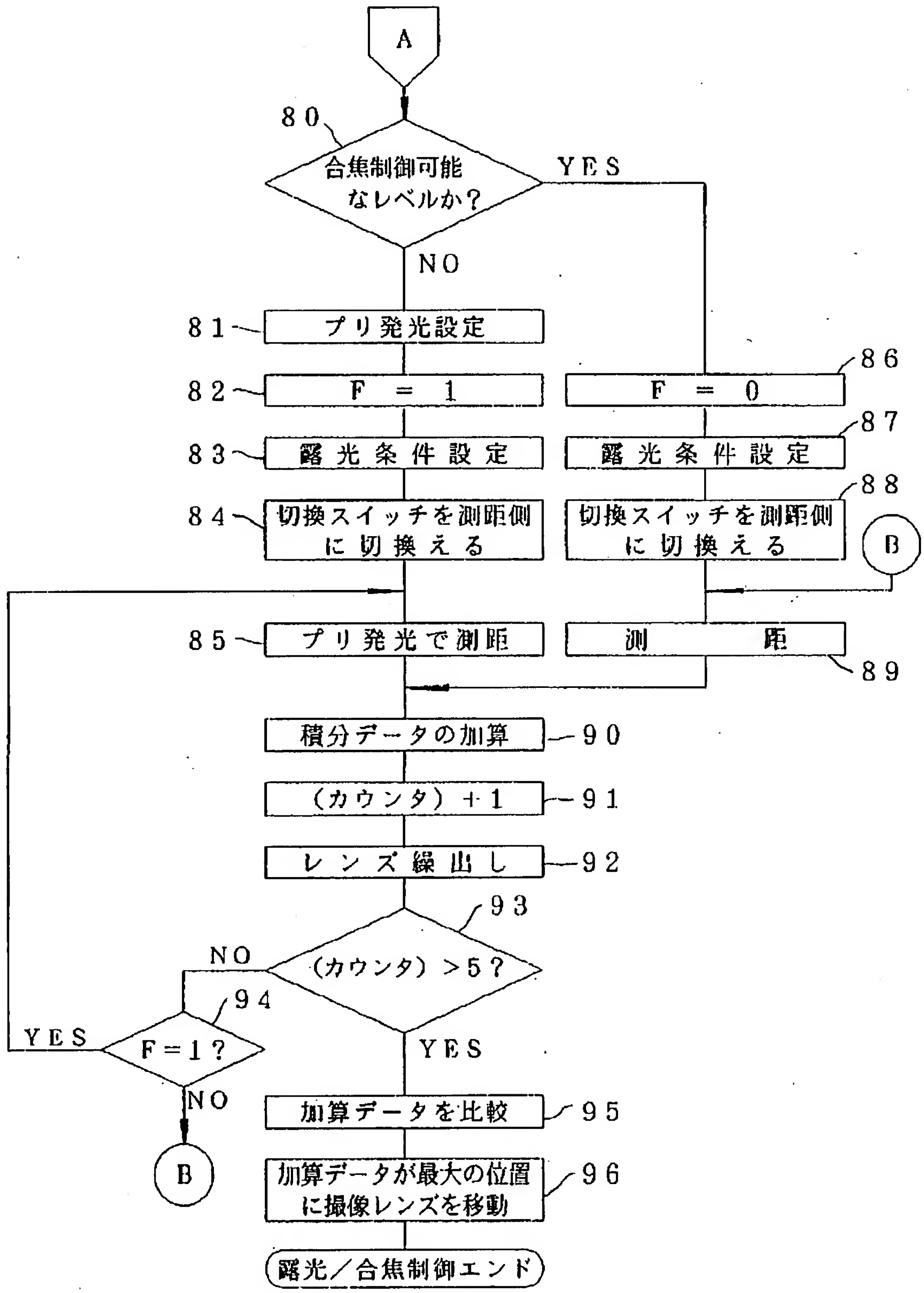
[Drawing 8]



[Drawing 9]


露光／合焦制御スタート
予備測光／測距
70
露光条件初期設定
71
撮像レンズを初期位置に繰出す
72
切換スイッチを測光側に切換える
73
測光
74
測光値演算
75
76
測光値が適切か？
YES
A
NO
露光条件変更
77
加算データをクリア
78
カウンタをクリア，撮像レンズを初期位置に戻す
79

[Drawing 10]



[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] In the video camera equipped with the image pick-up optical system containing the solid-state electronic image sensor which changes and outputs the light figure which carries out incidence through an image pick-up lens and this image pick-up lens to a video signal From the video signal outputted from the above-mentioned solid-state electronic image sensor, extract the high frequency component for focus detection, and with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component, a photometry means to measure photographic subject brightness, and the above-mentioned photometry means The level of the measured photographic subject brightness with the source of a fill-in flash and the above-mentioned judgment means for projecting a fill-in flash on the judgment means and photographic subject which judge whether it is below the predetermined level that is extent in which the focus control by the above-mentioned focus control means is impossible It is the video camera equipped with the control means controlled to project a fill-in flash on a photographic subject using the above-mentioned source of a fill-in flash when judged below with the above-mentioned predetermined level, and to perform the above-mentioned focus control using the above-mentioned focus control means.
[Claim 2] The video camera according to claim 1 which is a thing including a stroboscope luminescence device control means to control so that the above-mentioned source of a fill-in flash becomes fixed [the luminescence quantity of light of stroboscope luminescence equipment and this stroboscope luminescence equipment].
[Claim 3] The video camera according to claim 1 whose above-mentioned source of a fill-in flash is a red light emitting device.
[Claim 4] The video camera according to claim 1 which is that to which the above-mentioned photometry means extracts the component about a luminance signal, and measures photographic subject brightness based on the component about the extracted luminance signal from the video signal outputted from the above-mentioned solid-state electronic image sensor.
[Claim 5] The video camera according to claim 1 whose above-mentioned photometry means is a photometry component.
[Claim 6] The light figure which carries out incidence through an image pick-up lens and this image pick-up lens is changed into a video signal. The solid-state electronic image sensor to output In the video camera which extracted the high frequency component for focus detection, and was equipped with the focus control means which performs focus control of the above-mentioned image pick-up lens from the extracted high frequency component from the video signal outputted from the image pick-up optical system and the above-mentioned solid-state electronic image sensor which are included When photographic subject brightness was measured, and the level of the measured photographic subject brightness judges whether it is below the predetermined level that is extent in which the focus control processing by the above-mentioned focus control means is impossible and is judged to be below the above-mentioned predetermined level being alike -- the focus approach of a video camera of projecting a fill-in flash on a photographic subject, and performing the above-mentioned focus control processing

based on the above-mentioned high frequency component by the above-mentioned focus control means from which the above-mentioned high frequency component was extracted [, from which were extracted and it was extract-processed].
[Claim 7] The focus approach of the video camera according to claim 6 which is what is controlled so that it is projected on the above-mentioned fill-in flash from stroboscope luminescence equipment and it becomes fixed [the luminescence quantity of light of this stroboscope luminescence equipment].
[Claim 8] The focus approach of a video camera according to claim 6 that the above-mentioned fill-in flash is that on which it is projected from a red light emitting device.
[Claim 9] The focus approach of a video camera according to claim 6 that the above-mentioned measurement of photographic subject brightness is what extracts the component about a luminance signal and measures photographic subject brightness based on the component about the extracted luminance signal from the video signal outputted from the above-mentioned solid-state electronic image sensor.
[Claim 10] The focus approach of a video camera according to claim 6 which is that to which the above-mentioned measurement of photographic subject brightness is performed by the photometry component.

[Translation done.]